

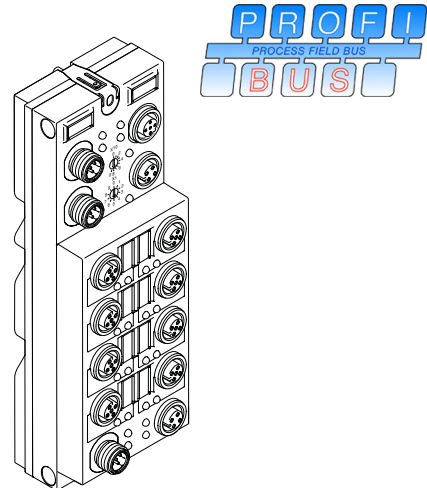
FLS PB M12 DIO 4/4 M12-2A

**Fieldline Stand-Alone device for PROFIBUS DP
with four digital inputs
and four digital outputs**

AUTOMATION

Data sheet
6631_en_03

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1 Description

This device is used to acquire and output digital signals.

Features

- Connection to PROFIBUS DP using M12 connectors (B-encoded)
- Baud rate with up to 12 Mbaud autobaud
- Connection of digital sensors using M12 connectors
- Connection of digital actuators using M12 connectors, each with a load capacity of 2 A (nominal current)
- Flexible power supply concept
- Diagnostic and status indicators
- Short-circuit and overload protection of the outputs and sensor supply
- IP 65/IP 67 protection



Make sure you always use the latest documentation.
It can be downloaded at www.phoenixcontact.com.



This data sheet is only valid in association with the FLS FLM SYS INST UM E and FLS FLM PB SYS PRO UM E user manuals.

2 Ordering data

Products

Description	Type	Order No.	Pcs./Pkt.
Fieldline Stand-Alone device for PROFIBUS with four digital inputs and four digital outputs	FLS PB M12 DIO 4/4 M12-2A	2736107	1

Accessories

Description	Type	Order No.	Pcs./Pkt.
Protective caps (for unused female connectors)	PROT-M12	1680539	5
Protective caps (for unused male connectors)	PROT-M12-FS	1513596	5
5-pos. shielded female connector, M12 B-encoded, for the incoming remote bus	SACC-M12FSB-5CON-PG9 SH AU	1507777	1
5-pos. shielded male connector, M12 B-encoded, for the outgoing remote bus	SACC-M12MSB-5CON-PG9 SH AU	1507764	1
PROFIBUS M12 T-piece, 12 Mbaud	SAC-M12T/2XM12 PB DP	1507780	1
PROFIBUS M12 termination resistor	SAC-5P-M12MS PB TR	1507803	1
Marking labels	ZBF 12:UNBEDRUCKT	0809735	10



For additional accessories for connecting the sensors and actuators, please refer to the Phoenix Contact PLUSCON catalog.

Documentation

Description	Type	Order No.	Pcs./Pkt.
"Installation of devices in the Fieldline product range" user manual	FLS FLM SYS INST UM E	-	-
"Configuring a PROFIBUS system using devices in the Fieldline product range" user manual	FLS FLM PB SYS PRO UM E	-	-

3 Technical data

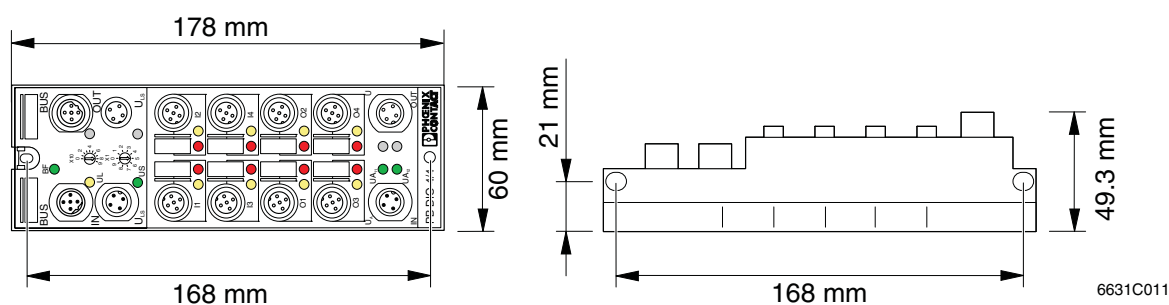


Figure 1 Dimensions of the device

FLS PB M12 DIO 4/4 M12-2A

General data

Order designation	FLS PB M12 DIO 4/4 M12-2A
Order No.	2736107
Housing dimensions (width x height x depth)	60 mm x 178 mm x 49.3 mm
Weight	340 g, approximately
Operating mode	Process data mode with 8 bits
Connection method for sensors	2, 3 or 4-wire technology
Connection method for actuators	2 or 3-wire technology
Permissible temperature (operation)	-25°C to +60°C
Permissible temperature (storage/transport)	-25°C to +85°C
Permissible humidity (storage/transport)	95%



For a short period, slight condensation may appear on the outside of the housing.

Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2000 m above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP65/IP67 according to IEC 60529
Protection class	Class 3 according to VDE 0106, IEC 60536

Mechanical requirements

Vibration test, sinusoidal vibrations according to EN 60068-2-6	5g load in each space direction
Shock test according to EN 60068-2-27	30g load, half sinusoidal wave positive and negative in each space direction



For additional information about mechanical requirements and ambient conditions, please contact Phoenix Contact.

Power supply

Supply voltage	24 V DC
Range	18 V DC to 30 V DC
Current consumption at U_L at 24 V DC	40 mA, typical (100 mA, maximum)
Current consumption at U_S at 24 V DC	4.5 mA + sensor current, typical (700 mA, maximum)
Current consumption at U_{Axx} at 24 V DC	6 mA + actuator current, typical (4 A, maximum)

Digital inputs

Number	4
Input design	According to IEC 61131-2 Type 1
Definition of switching thresholds	
Maximum low-level voltage	$U_{Lmax} < 5 \text{ V}$
Minimum high-level voltage	$U_{Hmin} > 11 \text{ V}$
Nominal input voltage	24 V DC
Range	$-30 \text{ V DC} < U_{IN} < +30 \text{ V DC}$
Nominal input current	5 mA
Current flow	Linear in the range $1 \text{ V} < U_{IN} < 30 \text{ V}$
Delay time	$t_{ON} < 3.1 \text{ ms}$, typical $t_{OFF} = 4.1 \text{ ms}$, typical
Permissible cable length to the sensor	100 m

Input characteristic curve

Input voltage (V)	Typical input current (mA)
$30 < U_{IN} < 0.7$	0
3	0.5
6	1.0
9	1.6
12	2.3
15	3.0
18	3.8
21	4.5
24	5.2
27	6.0
30	6.7

Sensor supply

Minimum sensor voltage	$U_S - 1 \text{ V}$
Nominal current per channel	75 mA
Nominal current per device	300 mA
Overload protection	Electronic per device
Short-circuit protection	Electronic per device

Error messages to the higher-level control or computer system

Sensor supply short circuit	Yes
Sensor supply overload	Yes



If an error is triggered by an overload or short circuit of the sensor supply, the device switches off the sensor supply to all the channels and sends an error message to the master.
If the sensor supply U_S is too low, the device sends an error message to the master (see "Diagnostic data" on page 14).

Digital outputs

Number	4
Nominal output voltage U_{OUT}	$U_{Axx} - 1 \text{ V}$
Differential voltage at I_{nom}	$\leq 1 \text{ V}$
Nominal current I_{nom} per channel	2 A
Total current	8 A (observe derating)
Possible output current during short circuit	22 A, maximum for 300 μs



Please take this value into account when selecting the power supply unit.

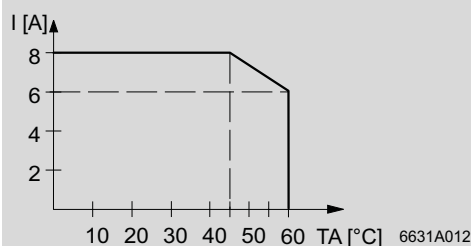
Protection	Short circuit; overload
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Single chip structure, i.e., all channels are thermally isolated.

Digital outputs (continued)

Derating at 100% simultaneity



Nominal load per channel

– Ohmic	48 W
– Inductive	48 VA (1.2 H, 12 Ω)
– Lamp	48 W

Signal delay upon power up of:

– Nominal ohmic load	Approximately 200 μs, typical
– Nominal inductive load	Depending on inductive time constant
– Nominal lamp load	Approximately 200 μs, typical

Signal delay upon power down of:

– Nominal ohmic load	Approximately 250 μs, typical
– Nominal inductive load	150 ms (1.2 H, 12 Ω), approximately; depending on inductive time constant
– Nominal lamp load	250 μs, approximately

Switching frequency with:

– Nominal ohmic load	500 Hz, maximum
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This switching frequency is limited by the number of bus devices, the bus configuration, the software used, and the control or computer system used.

– Nominal inductive load	0.1 Hz (1.2 H, 12 Ω), maximum
– Nominal lamp load	500 Hz

Overload response

Auto restart

Restart frequency with ohmic overload (2 Ω)

45 Hz, approximately

Response with inductive overload

Output may be damaged

Reverse voltage protection against short pulses

Protected against reverse voltages

Resistance to permanently applied reverse voltages

No

Response upon power down

The output follows the supply voltage without delay

Validity of output data after connecting the power supply (power up)

5 ms, typical

Limitation of the voltage induced on circuit interruption

-11 V, approximately

Single maximum energy in free running

1500 W

Protective circuit type

Integrated free-wheeling diode for each channel

Overcurrent shutdown

2.6 A, minimum

Output current when switched off

20 μA, maximum

Output current with ground connection interrupt when switched off

5 mA, maximum

Error messages to the higher-level control or computer system

Overload of outputs

Yes



If an error is triggered at the outputs by an overload, the device switches off the corresponding output and sends an error message to the master (see "Diagnostic data for device diagnostics" on page 14).

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Output characteristic curve when switched on (typical)

Output current (A)	Differential output voltage (V)
0	0
0.20	0.01
0.40	0.03
0.75	0.05
1.0	0.07
1.5	0.12
1.75	0.13
2.00	0.17

Output characteristic curve when switched off ($U_{Axx} = 30$ V DC, typical)

Load resistance ($k\Omega$)	Output voltage (V)
∞	1.5
1000	0.9
100	0.1
10	0.01
1	0.001

Output characteristic curve for ground connection interrupt ($U_{Axx} = 30$ V DC)

Load resistance ($k\Omega$)	Output voltage (V)
∞	29.9
1000	28.8
100	25.0
10	13.6
1	3.8

Interface

Bus system PROFIBUS DP

Incoming bus

Coupling of shield connection Directly to FE
Transmission speed 12 Mbaud, maximum

Outgoing bus

Coupling of shield connection Directly to FE
Transmission speed 12 Mbaud, maximum



For transmission speeds of more than 3 Mbaud, T-pieces with integrated series inductance must be used.

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Electrical isolation/isolation of the voltage areas



For device connection, please note the instructions and regulations in the "Installation of devices in the Fieldline product range" user manual, FLS FLM SYS INST UM E.

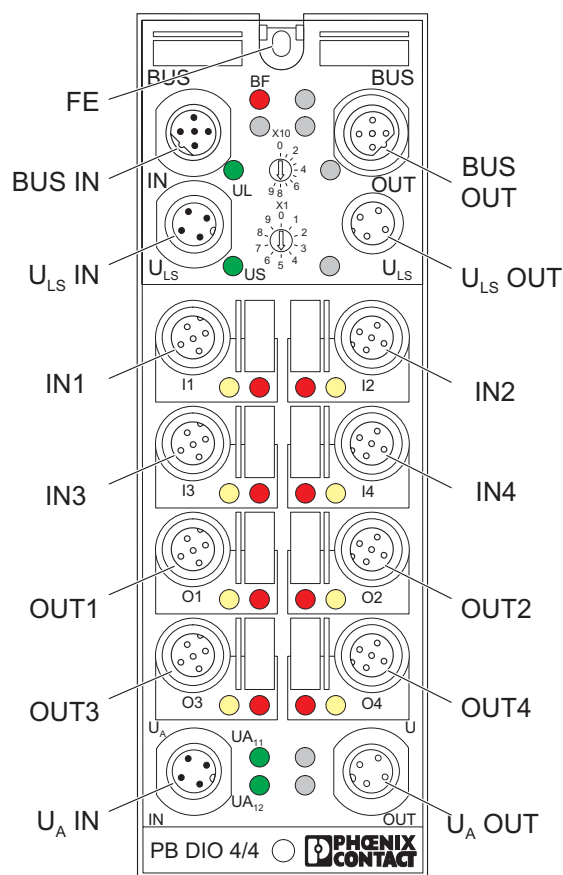
Separate potentials in the FLS PB M12 DIO 4/4 M12-2A I/O device

Test distance	Test voltage
24 V supply (bus logic)/bus connection	500 V AC, 50 Hz, 1 min.
24 V supply (bus logic)/FE	500 V AC, 50 Hz, 1 min.
24 V supply (bus logic)/digital inputs (sensor supply)	500 V AC, 50 Hz, 1 min.
24 V supply (bus logic)/digital outputs (actuator supply)	500 V AC, 50 Hz, 1 min.
Bus connection/FE	500 V AC, 50 Hz, 1 min.
Bus connection/digital inputs (sensor supply)	500 V AC, 50 Hz, 1 min.
Bus connection/digital outputs (actuator supply)	500 V AC, 50 Hz, 1 min.
FE/digital inputs (sensor supply)	500 V AC, 50 Hz, 1 min.
FE/digital outputs (actuator supply)	500 V AC, 50 Hz, 1 min.
Digital outputs (actuator supply)/digital outputs (actuator supply)	500 V AC, 50 Hz, 1 min.

Approvals

For the latest approvals, please visit www.download.phoenixcontact.com or eshop.phoenixcontact.com.

4 Pin assignment

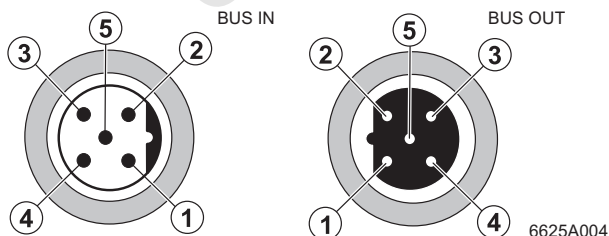


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Designation	Meaning
FE	Functional earth ground
BUS IN	PROFIBUS IN
BUS OUT	PROFIBUS OUT
U _{LS} IN	Power supply IN (logic and sensors)
U _{LS} OUT	Power supply OUT (logic and sensors) for additional devices
IN1 to IN4	Inputs 1 to 4
OUT1 to OUT4	Outputs 1 to 4
U _A IN	Power supply IN of the outputs (OUT1 to OUT4) with voltages U _{A11} and U _{A12}
U _A OUT	Power supply OUT for additional devices

Figure 2 Connections of the FLS PB M12 DIO 4/4 M12-2A

4.1 Pin assignment of the PROFIBUS connection



6625A004

Figure 3 PROFIBUS pin assignment (M12 B-encoded)

Pin	IN	OUT
1	VP	VP
2	RxD/TxD-N (A)	RxD/TxD-N (A)
3	DGND	DGND
4	RxD/TxD-P (B)	RxD/TxD-P (B)
5	Shield	Shield



The thread is used for additional shielding.

4.2 Pin assignment of the power supply U_{LS}

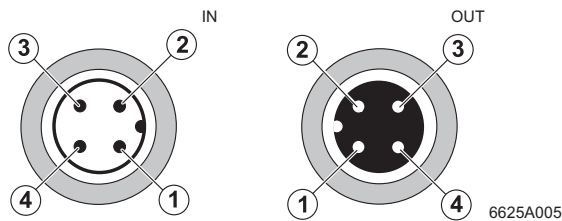


Figure 4 Pin assignment of the power supply U_{LS}

Pin	IN	OUT
1	$U_L +24\text{ V}$	$U_L +24\text{ V}$
2	$U_S\text{ GND}$	$U_S\text{ GND}$
3	$U_L\text{ GND}$	$U_L\text{ GND}$
4	$U_S +24\text{ V}$	$U_S +24\text{ V}$

4.3 Pin assignment of the power supply U_A of the outputs

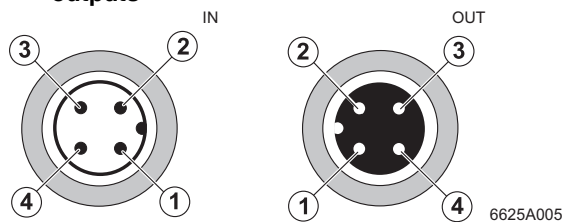


Figure 5 Pin assignment of the power supply U_A of the outputs

Pin	IN	OUT
1	$U_{A11} +24\text{ V}$	$U_{A11} +24\text{ V}$
2	$U_{A12}\text{ GND}$	$U_{A12}\text{ GND}$
3	$U_{A11}\text{ GND}$	$U_{A11}\text{ GND}$
4	$U_{A12} +24\text{ V}$	$U_{A12} +24\text{ V}$

4.4 Pin assignment of the inputs and outputs

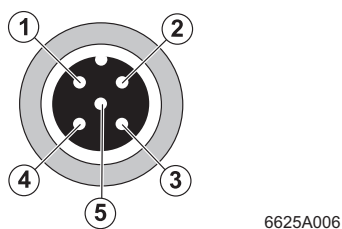
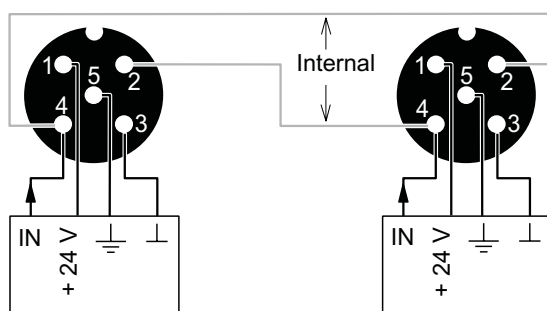


Figure 6 Pin assignment of the inputs and outputs

Pin	Female input connector	Female output connector
1	$U_S +24\text{ V}$	Not used
2	See Figure 7	Not used
3	GND	GND
4	Input	Output
5	FE	FE

4.5 Assignment of the female input connectors



Female connector 1 \leftrightarrow Female connector 2
Female connector 3 \leftrightarrow Female connector 4

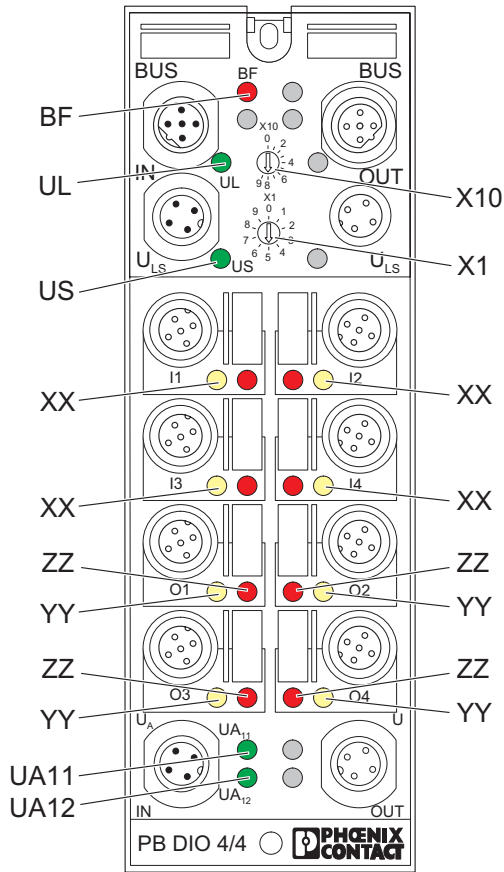
Figure 7 Assignment of the female input connectors



NOTE:

Two input signals can be connected to each female input connector. If both inputs of a female connector are used, the other female connector must not be used (1 or 2 and 3 or 4) (see Figure 7).

5 Local diagnostic and status indicators



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Figure 8 Indicators and rotary encoding switches of the FLS PB M12 DIO 4/4 M12-2A

Rotary encoding switches

The station address is set using rotary encoding switches X10 (for tens) and X1 (for units). The PROFIBUS master addresses the device by means of this station address.



The valid value range is between 1 and 99.
A new address value is only applied on device power up.

FLS PB M12 DIO 4/4 M12-2A

Designation	Color	Meaning
BF	Red LED	Bus error (bus failure)
	ON:	No cyclic data transmission: <ul style="list-style-type: none"> – PROFIBUS not connected, master not active – Incorrect settings (configuration via master, station address) – Synchronization or parameterization running – Timeout elapsed
	OFF:	<ul style="list-style-type: none"> – Device is addressed by PROFIBUS and is in the "cyclic process data exchange" state – Device supply not present (In this state the "UL" LED is also off due to the missing 24 V communications power.)
UL	Green LED	Communications power
	ON:	Communications power present
	OFF:	Communications power too low
US	Red/green LED	Power supply for IN1 to IN4
	ON (red):	Power supply overloaded
	ON (green):	Power supply present
	OFF:	Power supply too low
XX	Yellow LED	Status indicators for the inputs
	ON:	Input active
	OFF:	Input not active
YY	Yellow LED	Status indicators for the outputs
	ON:	Output active
	OFF:	Output not active
ZZ	Red LED	Overload of outputs
	ON:	Output overloaded
	OFF:	Output not overloaded
UA11	Green LED	Power supply for OUT1 and OUT2
	ON:	Power supply for OUT1 and OUT2 present
	OFF:	Power supply for OUT1 and OUT2 too low
UA12	Green LED	Power supply for OUT3 and OUT4
	ON:	Power supply for OUT3 and OUT4 present
	OFF:	Power supply for OUT3 and OUT4 too low

6 Internal basic circuit diagram

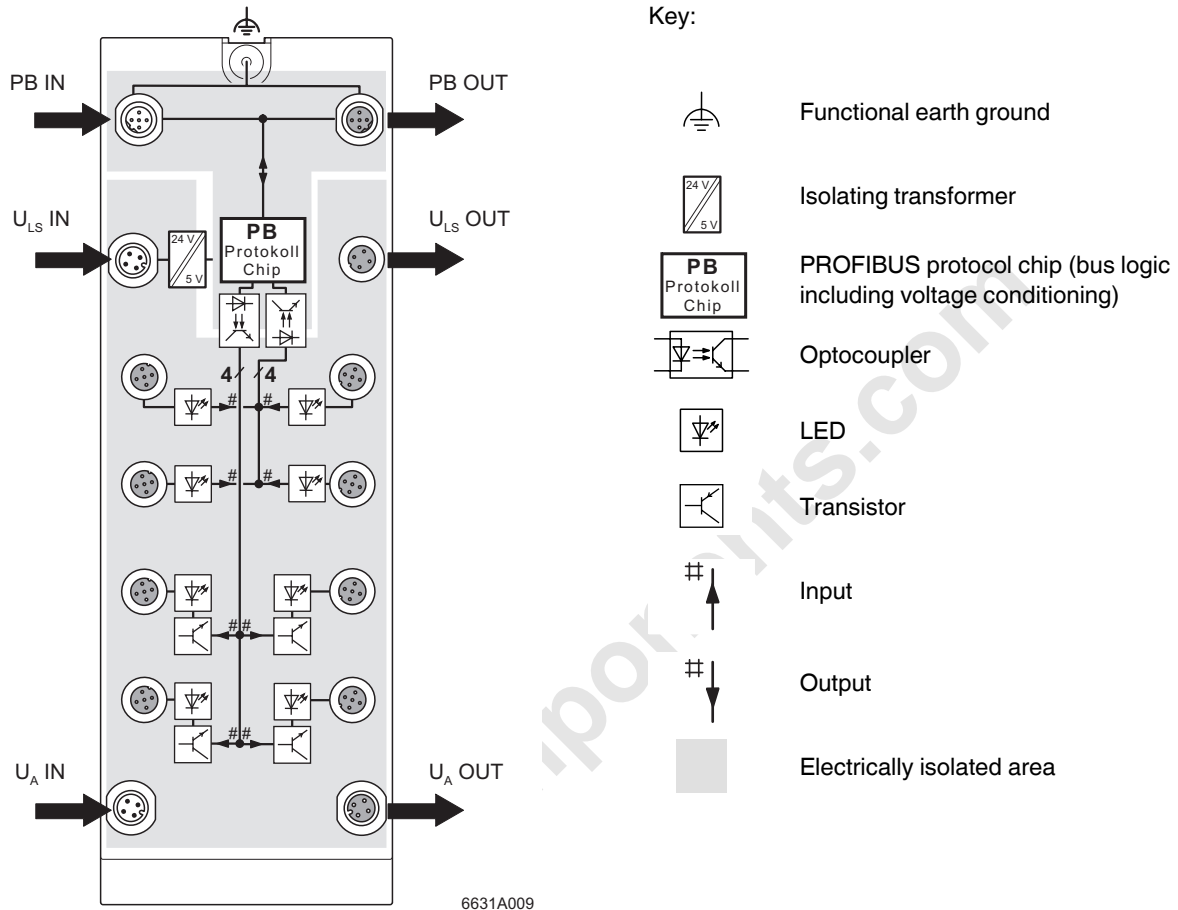
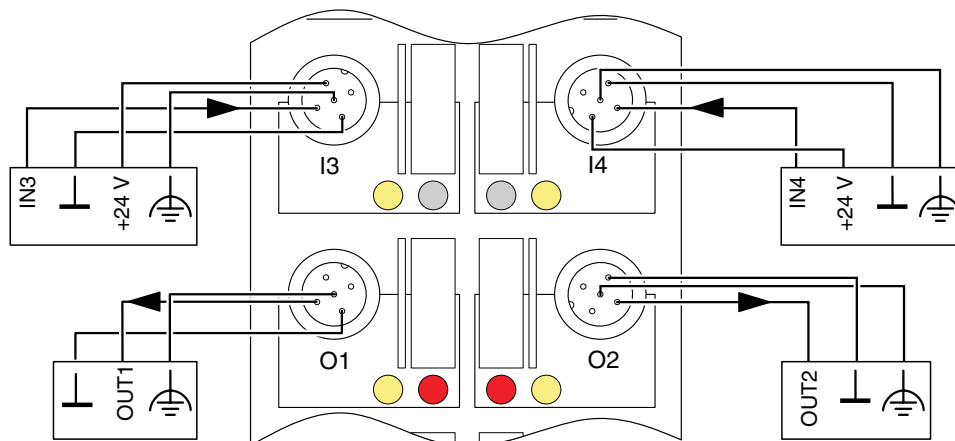


Figure 9 Internal wiring of the connections



For information about the electrically isolated areas, please refer to page 7.

7 Connection example



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Figure 10 Typical connection of sensors and actuators

8 Connection notes



NOTE: Meet noise immunity requirements

Connect FE using a mounting screw or a cable connection to the FE connection latch (when mounting on the side or on a non-conductive surface).



NOTE: Ensure degree of protection

To ensure IP65/IP67 protection, cover unused female connectors with protective caps.



NOTE: Avoid damage to the electronics

Only supply the sensors with the voltage U_S provided at the terminal points.



NOTE: Avoid polarity reversal

Avoid polarity reversal of the supply voltages U_L , U_S , and U_A in order to prevent damage to the device.



NOTE: Observe connection assignment

When connecting the sensors and actuators, observe the assignment of the connections to the PROFIBUS input and output data (see "Process data" on page 14).

9 Configuration data

ID number	066A _{hex}
Input address area	8 bits
Output address area	8 bits

10 Process data

10.1 Assignment of the terminal points to the IN process data

(Byte.bit) view	Byte	Byte 0							
	Bit	7	6	5	4	3	2	1	0
Device	Input	0	0	0	0	4	3	2	1



For bits 0.4 to 0.7 of the inputs the value is "0".

10.2 Assignment of the terminal points to the OUT process data

(Byte.bit) view	Byte	Byte 0							
	Bit	7	6	5	4	3	2	1	0
Device	Output	X	X	X	X	4	3	2	1



The assignment of bits 0.4 to 0.7 of the outputs has no effect on the output state.

11 Diagnostic data

11.1 Mapping of diagnostic data in PROFIBUS

Diagnostic data	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Remark
Byte 0	X	X	X	X	X	X	X	X	Station status 1
Byte 1	X	X	X	X	X	X	X	X	Station status 2
Byte 2	X	X	X	X	X	X	X	X	Station status 3
Byte 3	X	X	X	X	X	X	X	X	Diagnostic master address
Byte 4	0	0	0	0	0	1	1	0	High ID number
Byte 5	0	1	1	0	1	0	1	0	Low ID number
Byte 6	0	0	0	0	0	1	1	1	Diagnostic header
Byte 7	M.7	M.6	M.5	M.4	M.3	M.2	M.1	M.0	Device diagnostics
Byte 8	0	0	0	0	0	0	0	0	Reserved
Byte 9	0	0	0	0	0	0	0	0	Reserved
Byte 10	0	0	0	0	0	0	0	0	Reserved
Byte 11	0	0	0	0	0	0	0	0	Reserved
Byte 12	X	X	0	0	0	0	0	0	Reserved



Bytes 0 to 6 are PROFIBUS standard. Bytes 7 to 12 are device-specific.

11.2 Diagnostic data for device diagnostics

Bit	Remark	Assignment
M.0 - M.2	Reserved	0
M.3	Status of the sensor supply U_S	1, if U_S is too low
M.4	Reserved	0
M.5	Overload status of the outputs	OUT1 to OUT4
M.6	Status of the device supply U_L	1, if U_L too low
M.7	Overload status of the sensor supply U_S	1, if sensor supply is overloaded



If a diagnostic event occurs, the diagnostic data is sent to the master by means of a diagnostic telegram generated once by the device. The current status of the data can be read by the device at any time.